# 105,411

# PATENT SPECIFICATION

*Application Date, Apr. 14, 1916. No. 5521/16.*
*Complete Left, Oct. 13, 1916.*
*Complete Accepted, Apr. 16, 1917.*

## PROVISIONAL SPECIFICATION.

## Improvements relating to Tubular Earths for Electrical Conductors.

I, KILLINGWORTH WILLIAM HEDGES, of 10, Cranley Place, South Kensington, London, S.W., Civil Engineer, do hereby declare the nature of this invention to be as follows:—

This invention has reference to tubular earths for electrical conductors for the purpose of making good connections with the surrounding ground, and it has for its object improvements in such tubular earths and in the means for securing good electrical contact between the conductor and the tubular earth.

According to this invention, the tubular earth, if made of cast metal, is formed with a cup and neck projection preferably from the side near the top, the cup being provided with a loose metal disc or washer which rests against a shoulder at the bottom of the cup and may be provided with a gland or the like; the disc or washer is formed with an opening to suit the size and shape of conductor (tape or cable) which is threaded through the disc and passed to the bottom of the tubular earth, the cup and the gland (if used) being formed with an opening therethrough to receive the tape or cable conductor and allow the same to pass into the tubular earth. The electrical joint is made by employing lead wool, spongy lead, or the like which is inserted in the cup above the disc and surrounding the conductor and tamped into place or compressed therein by the gland analogous to a packing. The electrical joint can also be made by pouring into the cup molten lead or potmetal, in which case the gland is not required. The cast tubular earth may be made in convenient lengths adapted to be readily fitted together by any known means, the electrical joints being ensured preferably by the aid of a strip of lead or lead wool or spongy lead or the like. The lower part of the tubular earth is perforated to admit moisture and the lower extremity may be fashioned as a coarse screw thread or conical spiral borer so that by rotating the tubular earth the same may be caused to screw itself into the ground. When the conductor enters at the side, the upper part of the tubular earth is preferably provided with a cap which is placed in position after the interior of the tubular earth surrounding the conductor has been packed with carbon, and serves to mark the position of the earth. The upper part of the tubular earth (when the cup is at the top) may be formed or provided with a flange for a similar purpose. An inlet water pipe may be fitted to the upper part of the tubular earth.

When using wrought metal tubes, the upper end thereof is secured in a socket the upper part of which is formed with a neck and a cup. A loose metal disc or washer (which is formed with an opening therethrough to receive the conductor) is fitted into the bottom of the cup so that after the conductor is in position the electrical joint may be made by lead wool, spongy lead, or the like

which is inserted in the cup surrounding the conductor and tamped into place. An inlet water pipe may be fitted to the neck. In some cases the cup may be arranged as opening from the side above the neck. The lower part of the tube, which is perforated, may be provided with a conical spiral borer as previously set forth.

In order to increase the conductivity between the conductor and the surrounding carbon, the conductor may be fitted with pieces of carbon in the form of discs or tubes or the like before inserting the conductor into the tube. In some cases, the lower end of the conductor may be attached to a plug which may be employed to close the lower end of the tubular earth, and make electrical contact with the bottom of the tube.

When used for earthing live wires or conductors employed for conveying electricity for lighting or power purposes, it is necessary to specially insulate the conductor where it is carried under ground; preferably the upper portion of the tubular earth should also be insulated in order to prevent leakage of current to the surface ground. With this object the conductor may be carried in a trough or tube filled with insulating material up to the tubular earth; similarly, the upper part of the tubular earth may be surrounded with an insulating material contained in a suitable receptacle, for which purpose a bell or other shaped sleeve may be used to surround the upper part of the tubular earth, the length thus protected varying with the nature of the soil, the sleeve being filled with a suitable insulating material, either by running in hot (as in the case of asphaltum or pitch compounds) or by packing cold with asbestos or mica compounds. The metallic joint where the conductor enters the tubular earth may be similarly protected with a sleeve and insulating material.

Dated this 14th day of April, 1916.

K. W. HEDGES.

By Arthur C. Downing,
7, Quality Court, Chancery Lane, London, W.C.,
Agent for Applicant.

## COMPLETE SPECIFICATION.

### Improvements relating to Tubular Earths for Electrical Conductors.

I, KILLINGWORTH WILLIAM HEDGES, of 10, Cranley Place, South Kensington, London, S.W., Civil Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has reference to tubular earths for electrical conductors for the purpose of making good connections with the surrounding ground, and it has for its object improvements in such tubular earths and in the means for securing good electrical contact between the conductor and the tubular earth.

According to this invention, the tubular earth is formed with a cup and neck which may extend from the side of the tubular earth near the top or from the upper end of the tubular earth, the cup having an opening therethrough so as to form an annular shoulder upon which is located a loose metal disc or washer which is formed with an opening to suit the size and shape of conductor (tape or cable); the electrical joint is made by employing lead wool, spongy lead, lead shavings or the like which is inserted in the cup above the disc and surrounding the conductor and tamped into place.

The accompanying drawings illustrate several examples of tubular earths constructed according to my invention.

Fig. 1 is a plan and Fig. 2 is a sectional elevation of a cast metal tubular earth with the conductor entering at the side. Fig. 3 represents an example of an electrical joint between two parts of a tubular earth. Fig. 4 is a plan

view of the metal disc or washer. Fig. 5 is a section of a grid top to admit surface water. Fig. 6 is an elevation of the lower part of a tubular earth.

Figs. 7 and 8 are sectional elevations of a cup and neck with the conductor entering at the top.

Fig. 9 is a section of a lower part of a tubular earth fitted with a removable extremity.

Fig. 10 is a plan and Fig. 11 is a sectional elevation of a modified form of disc.

Referring to Figs. 1 and 2 the tubular earth *a* is formed with a cup *b* and neck *c* projecting from the side near the top, the cup being provided with a loose metal disc or washer *d* which rests against a shoulder and thus forms the bottom of the cup; the disc or washer *d* is formed with an opening *e* (Fig. 4) to suit the size and shape of conductor *f* (tape or cable) which is threaded through the disc and passed to the bottom of the tubular earth, the cup *b* being formed with an opening *g* therethrough to receive the tape or cable conductor and allow the same to pass into the tubular earth. The electrical joint is made by employing lead wool, spongy lead, lead shavings, or the like *h* which is inserted in the cup above the disc and surrounding the conductor and tamped into place. The electrical joint can also be made by pouring into the cup molten lead or potmetal. The cast tubular earth shown may be made in convenient lengths adapted to be readily fitted together by any known means, the electrical joints being ensured preferably by the aid of a strip of lead as indicated at *i* in Fig. 3 or lead wool or spongy lead or the like. The lower part of the tubular earth shown in Fig. 6 is perforated at *k* to admit moisture and the lower extremity may be fashioned as a coarse conical screw thread *l* or conical spiral borer so that by rotating the tubular earth the same may be caused to screw itself into the ground. When the conductor enters at the side as in Figs. 1 and 2, the upper part of the tubular earth is preferably provided with a movable cap *m* or a movable grid $m^1$ which is placed in position after the interior of the tubular earth surrounding the conductor has been packed with carbon, and serves to mark the position of the earth. The upper part of the tubular earth (when the cup is at the top as in Figs. 7 and 8) may be formed or provided with a flange for a similar purpose. An inlet water pipe *n* may be fitted to the upper part of the tubular earth.

When using wrought metal tubes for the tubular earth *a* as in Figs. 7 and 8, the upper end thereof is secured in a socket *o* the upper part of which is formed with a neck *c* and a cup *b*. In Fig. 7 the tube is secured by means of set screws *p* and in Fig. 8 by means of screw threads. The loose metal disc or washer *d* (which is formed with an opening therethrough to receive the conductor) it fitted into the bottom of the cup so that after the conductor is in position the electrical joint may be made by lead wool, spongy lead, lead shavings, or the like *h* which is inserted in the cup surrounding the conductor and tamped into place. An inlet water pipe *n* may be fitted to the neck. In some cases the cup may be arranged as opening from the side (as in Figs. 1 and 2) above the neck *c*.

The lower part of the tube may be perforated as shown in Fig. 6, or it may be provided with a removable plug *r* (Fig. 9) which may be driven out of the tube *a* as indicated by the dotted lines before the introduction of the conductor, the carbon packing filling up the gap between the tube and the plug. In some cases the conductor is attached to the plug.

In order to increase the conductivity between the conductor and the surrounding carbon, the conductor may be fitted with pieces of carbon in the form of plates *s* at each side as in Fig. 9 or discs or tubes or the like before inserting the conductor into the tube but after threading the conductor through the disc *d*.

When used for earthing live wires or conductors employed for conveying electricity for lighting or power purposes, it is necessary to especially insulate

the conductor where it is carried under ground; preferably the upper portion of the tubular earth should also be insulated in order to prevent leakage of current to the surface ground. With this object the conductor is usually carried in a trough or tube filled with insulating material up to the tubular earth; similarly, the upper part of the tubular earth may be surrounded with an insulating material contained in a suitable receptacle such as indicated by the dotted lines *t* in Fig. 2, for which purposes a bell or other shaped sleeve may be used to surround the upper part of the tubular earth, the length thus protected varying with the nature of the soil, the sleeve being filled with a suitable insulating material, either by running in hot (as in the case of asphaltum or pitch compounds) or by packing cold with asbestos or mica compounds. The metallic joint where the conductor enters the tubular earth may be similarly protected with a sleeve and insulating material.

In Figs. 10 and 11 a modified form of disc *d* is shown combining therewith a perforated part *u* to serve as the grid in Fig. 5 by admitting surface water. A wall *v* integral with the disc serves to contain the lead *h* used to make the electrical joint.

It is known to attach flexible conductors to commutator brushes or for uniting other bodies or articles by forming in one of such bodies a hole or aperture somewhat larger than the part of the other article or body which is inserted into the said hole, filling the space between the two articles with a metallic sponge, metal or alloy of a nature to be consolidated by pressure, and in a powdered or fragmentary condition, and consolidating this filling.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In tubular earths for electrical conductors, the method of securing good electrical contact between the conductor and the tubular earth, consisting in inserting the conductor through a loose metal disc or washer, which rests upon a shoulder within the entrance opening of the tubular earth and serves as the bottom thereof, and filling the cup thus formed with lead, lead wool, spongy lead, lead shavings, or the like, substantially as set forth.

2. An electrical contact for tubular earths, comprising an entrance opening for the conductor formed with a shoulder therein, a metal disc or washer resting upon said shoulder, and opening through the disc or washer to receive the conductor, and a lead filling tamped into the cup or poured thereinto in a molten state, substantially as set forth.

3. In tubular earths according to Claims 1 and 2, where the conductor opening is at the side, the employment of a movable grid top to the tube, substantially as set forth.

4. In tubular earths according to Claims 1 and 2, the employment of a disc formed with a wall separating a perforated or grid part from the conductor contact part, substantially as set forth.

5. The combination with tubular earths constructed according to the preceding claims of a removable plug at the bottom of the tube adapted to be driven out of the bottom after the tube has been inserted in the ground, substantially as and for the purpose set forth.

6. Tubular earths constructed in the several manners substantially as hereinbefore described and illustrated by the accompanying drawings.

Dated this 13th day of October, 1916.

K. W. HEDGES.

By Arthur C. Downing,
7, Quality Court, Chancery Lane, London, W.C.,
Agent for Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1917.

FIG. 1.

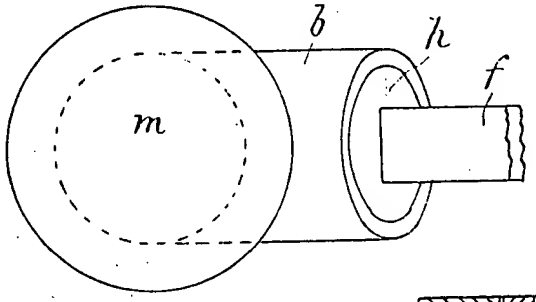



FIG. 5.

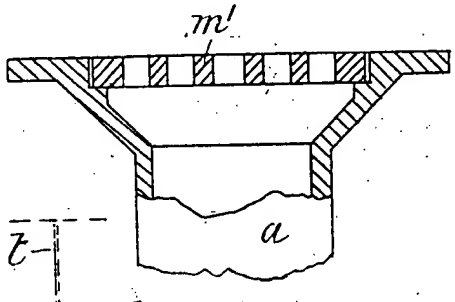



FIG. 2.

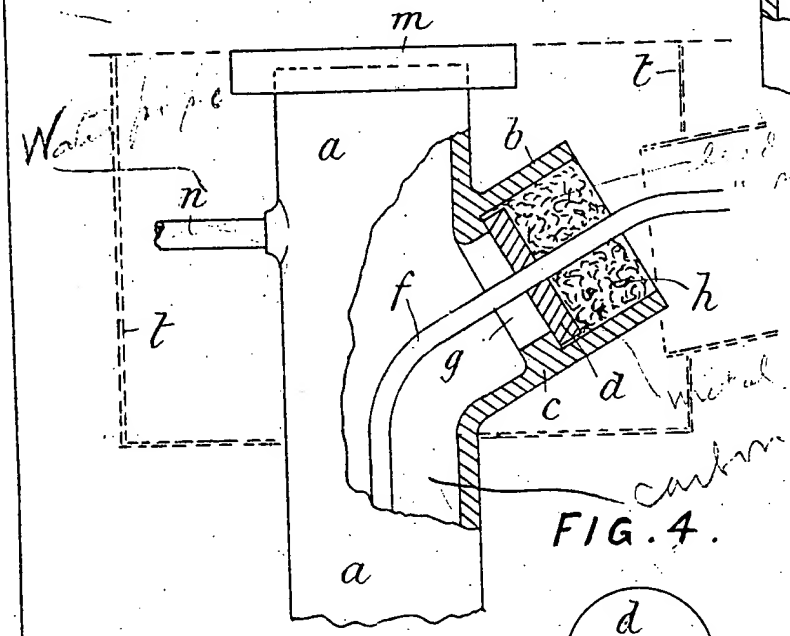



FIG. 6.

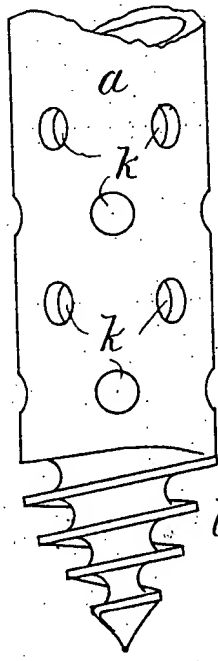
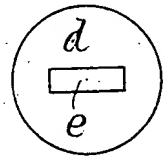



FIG. 4.



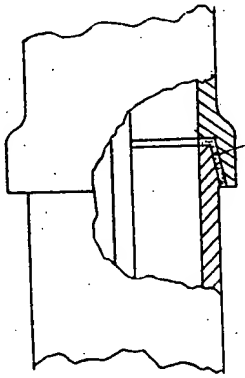




FIG. 3.